

WHAT IS CLAIMED IS:

1. A synthetic microsphere, comprising:  
a synthetic, substantially spherical wall;  
wherein the microsphere has a particle diameter of greater than about 30 microns, wherein the microsphere comprises a pre-determined amount of at least one aluminosilicate material and at least one pre-selected chemical, wherein the microsphere has an alkali metal oxide content of less than about 10 wt.%, based on the weight of the microsphere.
2. The synthetic microsphere of Claim 1, wherein the substantially spherical wall defines at least one inner void, wherein the at least one inner void is synthetically formed by a pre-determined amount of a blowing agent.
3. The synthetic microsphere of Claim 2, wherein the blowing agent is selected from the group consisting of powdered coal, carbon black, graphite, carbonaceous polymeric organics, oils, sugar, starch, polymeric organic oils, polyvinyl alcohol, carbonates, carbides, sulfates, sulfides, nitrides, nitrates, glycol, glycerine, and combinations thereof.
4. The synthetic microsphere of Claim 2, wherein the at least one inner void has a volume of between about 30-95% of the aggregate volume of the microsphere.
5. The synthetic microsphere of Claim 1, wherein the synthetic substantially spherical wall has a make-up comprising an aluminosilicate material and the at least one pre-selected chemical, wherein the at least one pre-selected chemical acts as a binding agent.
6. The synthetic microsphere of Claim 5, wherein the at least one pre-selected binding agent is selected from the group consisting of alkali metal silicates, alkali metal aluminosilicates, alkali metal borates, alkali or alkaline earth metal carbonates, alkali or alkaline earth metal nitrates, alkali or alkaline earth metal nitrites, boric acid, alkali or alkaline earth metal sulfates, alkali or alkaline earth metal phosphates, alkali or alkaline earth metal hydroxides, sugar, starch, ultra fine fly ash, Class C fly ash, Class F fly ash, colloidal silica, inorganic silicate cements, organic polymers, and combinations thereof.
7. The synthetic microsphere of Claim 1, wherein the alkali metal oxide content of the microsphere is between about 2 to 10 wt.%.

8. The synthetic microsphere of Claim 1, wherein the microsphere is formulated to be substantially chemically inert in a caustic environment having a pH of about 12-14.

9. The synthetic microsphere of Claim 1, wherein the particle diameter of the microsphere is between about 30 to 1000 microns.

10. The synthetic microsphere of Claim 1, further comprising an aspect ratio of between about 0.8 and 1.

11. The synthetic microsphere of Claim 1, further comprising a wall thickness of between about 1 to 100 microns.

12. The synthetic microsphere of Claim 1, wherein the particle density of the microsphere is between about 0.1 and 2 g/cm<sup>3</sup>.

13. The synthetic microsphere of Claim 1, wherein the bulk density of the microsphere is less than about 1.4 g/cm<sup>3</sup>.

14. The synthetic microsphere of Claim 1, further comprising a composition of about 30 to 85 wt.% SiO<sub>2</sub>, about 2 to 45 wt.% Al<sub>2</sub>O<sub>3</sub>, and up to about 30 wt.% divalent material oxides, and up to about 20 wt.% of one or more metal oxides.

15. A synthetic microsphere comprising an outer wall defining a substantially enclosed synthetically formed cavity, wherein the microsphere comprises a material formed with a pre-selected formulation, wherein the formulation is configured to provide the microsphere with an alkali metal oxide content of less than about 10 wt.% based on the weight of the microsphere, wherein the average particle diameter of the synthetic microsphere is greater than about 30 microns.

16. The synthetic microsphere of Claim 15, wherein the pre-selected formulation comprises an aluminosilicate material.

17. The synthetic microsphere of Claim 16, wherein the pre-selected formulation comprises about 30 to 80 wt.% SiO<sub>2</sub>, about 2 to 45 wt.% Al<sub>2</sub>O<sub>3</sub>, up to about 30 wt.% divalent metal oxide, up to about 10 wt.% monovalent metal oxide, and up to about 20 wt.% of one or more metal oxides.

18. The synthetic microsphere of Claim 15, wherein the microsphere comprises about 1 to 10 wt.% sodium oxide.

19. The synthetic microsphere of Claim 15, wherein the mass ratio of silica to alumina is greater than unity.

20. The synthetic microsphere of Claim 15, wherein the average particle diameter of the microsphere is between about 30 and 1000 microns.

21. The synthetic microsphere of Claim 15, wherein the average particle diameter of the microsphere is between about 50 and 300 microns.

22. The synthetic microsphere of Claim 16, wherein the aluminosilicate material is calcined.

23. The synthetic microsphere of Claim 16, wherein the aluminosilicate material is derived from fly ash.

24. A plurality of synthetic microspheres comprising an alkali metal oxide content of less than about 10 wt.% based on the total weight of the microspheres, wherein the synthetic microspheres are formulated to have a pre-selected average particle diameter of greater than about 30 microns.

25. The synthetic microspheres of Claim 24, wherein the synthetic microspheres are formulated from aluminosilicate particles, wherein the particles have a pre-selected size range.

26. The synthetic microspheres of Claim 25, wherein the aluminosilicate particles have a pre-selected average particles size range of about 0.01 to 50 microns.

27. The synthetic microspheres of Claim 24, wherein each synthetic microsphere has a substantially spherical outer wall defining a synthetically formed, substantially enclosed cavity therein.

28. A formulation for forming a synthetic microsphere, comprising:  
a primary component comprising at least one aluminosilicate component having a particle diameter pre-selected to form a microsphere with a particle diameter greater than about 30 microns;

at least one chemical, wherein the at least one chemical comprises a binding agent that substantially binds the particles of the primary component together so as to form a precursor to make the synthetic microspheres;

wherein the primary component and the at least one chemical each having a sufficiently low or no alkali metal oxide content so as to maintain the alkali metal oxide content of the synthetic microsphere to less than about 10 wt.%.

29. The formulation of Claim 28, further comprising a blowing agent, wherein the blowing agent can be combined with the primary component and the binding agent in a manner such that when activated, the blowing agent releases a gas that expands the precursor so as to form a substantially spherical wall enclosing a cavity therein.

30. The formulation of Claim 29, wherein the primary component comprises fly ash and the blowing agent is selected from the group consisting of carbon black, powdered coal, sugar, silicon carbide.

31. The formulation of Claim 29, wherein the primary component comprises basalt and the blowing agent is selected from the group consisting of carbon black, powdered coal, sugar, and silicon carbide.

32. The formulation of Claim 28, wherein the at least one chemical is selected from the group consisting of alkali metal silicate, alkali metal aluminosilicate, alkali metal borate, alkali or alkaline earth metal carbonates, alkali or alkaline earth metal nitrite, boric acid, alkali or alkaline earth metal sulfates, alkali or alkaline earth metal nitrate, alkali or alkaline earth metal phosphates, alkali or alkaline earth metal hydroxides, sugar, starch, ultra fine fly ash, class C fly ash, class F fly ash, colloidal silica, inorganic silicate cements, organic polymers and combinations thereof.

33. The formulation of Claim 29, wherein the blowing agent is substantially the same as the binding agent.